

1 ~~1~~. A dragline excavator bucket control system, said system comprising:  
a pair of hoist ropes and a drag rope, respective free ends of said hoist ropes being coupled adjacent opposite ends of a dragline bucket and said drag rope being coupled adjacent a front end of said dragline bucket, said hoist ropes being supported on an excavator boom on spaced respective inner and outer boom sheaves; and

a boom sheave support arm mounted adjacent a free end of said excavator boom to support said outer boom sheave to one side of a longitudinal axis of said boom whereby, in use, said pair of hoist ropes extending between respective sheaves and respective couplings to said bucket remain substantially parallel to retain said bucket in an optimal transport attitude when moving between a retracted and an extended position under the influence of said drag rope.

2 ~~2~~. A control system as claimed in claim ~~1~~ wherein in use, respective hoist rope boom support points and respective hoist rope bucket attachment points together define a substantially parallelogram shape in side elevation.

3 ~~3~~. A control system as claimed in claim ~~1~~ wherein said boom sheave support arm is rigidly mounted on said boom.

4 ~~4~~. A control system as claimed in claim ~~1~~ wherein said boom sheave support arm is pivotally mounted on said boom.

5 ~~5~~. A control system as claimed in claim ~~1~~ wherein said bucket, in use, is urged between a transport position and a dumping position by a dumping mechanism, said dumping mechanism being operable by lengthening one of said hoist ropes relative to the other hoist rope whereby gravitational forces cause movement of said bucket between a transport position and a dumping position.

6 ~~6~~. A control system as claimed in claim ~~1~~ wherein lengthening of one hoist rope relative to the other hoist rope is effected by separately controllable hoist rope drums.

7 ~~7~~. A control system as claimed in claim ~~6~~ wherein the separately controllable hoist rope drums are operated by a common drive.

8 ~~8~~. A control system as claimed in claim ~~6~~ wherein the separately controllable hoist rope drums are operated by respective drives.

9 ~~3~~ A control system as claimed in claim ~~8~~ wherein the separately controllable hoist rope drums are coupled by a selective engagement mechanism to permit, in use, a predetermined degree of differential relative rotation between said separately controllable hoist rope drums.

10 ~~9~~ A control system as claimed in claim ~~8~~ wherein the selective engagement mechanism comprises a clutch mechanism.

11 ~~9~~ A control system as claimed in claim ~~8~~ wherein the selective engagement mechanism comprises a differential gear assembly.

12 ~~9~~ A control system as claimed in claim ~~8~~ wherein the bucket, in use, is urged between a transport position and a dumping position by pivotal movement of said boom sheave support arm to effect a lengthening of one of said hoist ropes relative to the other hoist rope whereby gravitational forces cause movement of said bucket between a transport position and a dumping position.

13 ~~9~~ A control system as claimed in claim ~~8~~ wherein a self-compensating hoist rope take up system restores the bucket to a carry position under the influence of potential energy stored in said hoist rope take up system.

14 ~~9~~ A control system as claimed in claim ~~8~~ wherein the self-compensating hoist rope take up system comprises a suspended mass.

15 ~~9~~ A control system as claimed in claim ~~8~~ wherein the take up system comprises a spring biasing mechanism.

16 ~~9~~ A control system as claimed in claim ~~8~~ wherein the take up system comprises a hydraulic biasing mechanism.

17 ~~9~~ A control system as claimed in claim ~~8~~ wherein said hydraulic biasing system includes a pressure accumulating chamber.

18 ~~9~~ A control system as claimed in claim ~~8~~ wherein the self-compensating take up system is selected from a suspended mass, a spring biasing mechanism, a hydraulic biasing mechanism, or combinations thereof.

19 ~~18~~ A control system as claimed in claim ~~17~~ <sup>5</sup> wherein the bucket, in use, is urged between a transport position and a dumping position by a powered system effective to cause relative shortening of one hoist rope relative to the other.

~~20~~ <sup>18</sup> A control system as claimed in claim ~~18~~ wherein one of said hoist ropes is shortened relative to the other by a respective powered hoist rope drum.

~~21~~ <sup>19</sup> A method of operating a dragline excavator wherein a pair of hoist ropes are coupled adjacent opposite ends of a dragline bucket, said hoist ropes being supported on an excavator boom on spaced respective inner and outer boom sheaves, said outer boom sheave being supported by a boom sheave support arm to one side of a longitudinal axis of said excavator boom whereby, in use, said pair of hoist ropes extending between respective sheaves and respective couplings to said bucket remain substantially parallel to retain said bucket in an optimal transport attitude when moving between a retracted and an extended position under the influence of a drag rope coupled to said bucket.

~~22~~ <sup>20</sup> A method as claimed in claim ~~19~~ wherein said bucket is urged between a transport position and a dumping position by selectively lengthening or shortening of one of said pair of hoist ropes relative to the other hoist rope of said pair.

~~23~~ <sup>21</sup> A method as claimed in claim ~~20~~ wherein each of said pair of hoist ropes is coupled to a respective separately controllable hoist rope drum.

~~24~~ <sup>22</sup> A method as claimed in claim ~~21~~ wherein each hoist rope drum is selectively operable from a common drive.

~~25~~ <sup>23</sup> A method as claimed in claim ~~22~~ wherein each hoist rope drum is selectively operable by a respective drive.